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## Executive Summary

Washington State increasingly regulates airport stormwater runoff. To meet these regulations, many Washington airports are required to install stormwater treatment, flow control facilities or other best management practices (BMPs) within their operational area. However, typical BMPs often attract wildlife that are potentially hazardous to airplanes. To decrease wildlife-airplane interactions caused by stormwater facilities, the FAA and WSDOT partnered to create this Aviation Stormwater Design Manual (ASDM) to provide facility design guidance for maintaining adequate stormwater management features while minimizing hazardous attraction of wildlife.

This manual focuses on design modifications to decrease the attractiveness of stormwater facilities to wildlife rather than active wildlife removal measures. It draws heavily on WSDOT's Highway Runoff Manual and the Eastern and Western Washington Stormwater Management Manuals produced by the Washington State Department of Ecology. However, the ASDM is not considered equivalent to those manuals because it does not specify when stormwater controls are required (such as the amount of impervious surface or landscaped acreage for a project that triggers minimum requirements). Instead, the ASDM is considered a supplemental manual. It may be required by a permit, such as the NPDES stormwater permit, by the FAA; or due to limitations of other locally approved and equivalent stormwater manuals that do not address airport-specific safety considerations.

Care has been taken to ensure that the ASDM's design modifications still preserve the mechanisms facilities use to remove pollutants or control runoff flow rates. For example, a narrower, steeper pond discourages use by waterfowl but still has the same runoff storage volume; only the configuration of the pond design has changed.

Chapter 1 discusses three main sets of applicable regulations: airport operational requirements of the FAA, stormwater quality and quantity requirements administered by Ecology, and wildlife protections such as the Endangered Species Act. Stormwater management at airports must satisfy all of these regulations.

Chapter 2 contains a description of typical airport operations. Details include airport operation zones, safety requirements, and maintenance concerns.

Chapter 3 describes how to identify potentially hazardous species. Species with higher body mass (such as deer and cranes), present in large flocks (such as starlings), or with both large mass and high numbers (such as seagulls) represent the greatest hazards to airport operations. Research on habitat characteristics that attract or discourage different species is summarized. Site design, vegetative, and structural considerations are discussed, based on the identified species of concern for airports. The need for adaptive management is stressed as wildlife species and habits change with seasons and climate. Potential retrofits for existing stormwater facilities are also discussed.

Chapter 4 explains the selection process for stormwater facilities/BMPs, including flow charts for selecting facilities for flow control and for runoff treatment. There are several differences between the ASDM selection process and that of most other stormwater BMP manuals. The first is the need to identify potential hazardous wildlife. A second difference is the types of BMPs that are available. Facilities such as ponds and constructed wetlands which require permanent pools of water are not included. Although effective for controlling flows and pollutants, facilities with standing water also attract wildlife, especially waterfowl that are among the most hazardous types of wildlife around airports. The manual also describes underground vaults and filters, which, though generally more expensive to use, are safer, because of their unattractiveness to wildlife.

Chapter 5 addresses special load-bearing and potential ponding concerns about runoff infiltration in the airport environment. These concerns are especially relevant given the emphasis on low impact development measures in this manual (as well as other Washington stormwater manuals.)

Chapter 6 provides design details for individual stormwater facilities. Design information for each facility follows the same format. It is introduced with a photo or illustration where available, followed by a table showing the locations where that type of facility is appropriate and a brief **introduction** describing the facility. The introduction is followed by a discussion of **applications and limitations** with special attention paid to airport situations. **Structural design elements** are addressed for engineered facilities. **Site design elements** includes siting and sizing criteria. **Construction criteria** and **operations/maintenance** considerations make up the last two sections for most of the BMPs included in this chapter.

The manual includes design details for all of the facility types recommended for an airport environment, even if those BMPs are relatively unchanged from the Highway Runoff Manual or Ecology manuals. This allows the manual to be a standalone reference. Each of the BMPs in the ASDM has been assigned a number beginning with “AR” so that it is clear that the design details came from this manual. As more is learned about stormwater facilities at airports, it is anticipated that design details will be further adapted to better address airport-specific needs.

In addition to standing water, vegetation often determines whether wildlife will be attracted to stormwater facilities. Vegetation that minimizes the risk of hazardous wildlife attraction is detailed in an appendix. Based on positive experience at other airports, the vegetation appendix should provide a starting point for airport managers, engineers, and biologists, complementing the services of a certified airport wildlife biologist.

Although safety concerns preclude the use of ponds or wetlands with standing water, detention ponds that are designed to completely drain between runoff events are still a valuable part of airport stormwater design. Because covering ponds for safety can be very expensive, Appendix B provides modeling details to support the two-tiered detention pond design suggested in the manual.

The Aviation Stormwater Design Manual demonstrates that it is possible to design stormwater facilities that address airport safety, water quality, flow control and wildlife concerns at the same

time. The manual emphasizes an adaptive management approach for airports. An adaptive approach is also anticipated for the manual itself as more is learned about stormwater and wildlife at airports.

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